

CLAIMS

1. A polymer-based material comprising:
a polymer matrix material; and
metal particles dispersed in the matrix material; and
a dielectric coating individually encapsulating each of the metal particles so as to electrically insulate the metal particles from each other, the dielectric coating being insoluble in the matrix material and having a softening temperature below the melting temperature of the metal particles.
2. The polymer-based material according to claim 1, wherein the matrix material is formed of an epoxy, silicone, or polyurethane.
3. The polymer-based material according to claim 1, wherein the metal particles are formed of copper, aluminum or silver.
4. The polymer-based material according to claim 1, further comprising dielectric particles dispersed in the matrix material, the dielectric particles having a higher coefficient of thermal conductivity than the matrix material.
5. The polymer-based material according to claim 4, wherein the dielectric particles are formed of a ceramic material.
6. The polymer-based material according to claim 4, wherein the dielectric coating comprises second dielectric particles dispersed therein, the second dielectric particles being smaller than the dielectric particles dispersed in the matrix material.
7. The polymer-based material according to claim 6, wherein the second dielectric particles are formed of a ceramic material having a

higher coefficient of thermal conductivity than the matrix material.

8. The polymer-based material according to claim 1, wherein the dielectric coating is a polymer having a softening temperature of at least 175°C.

9. The polymer-based material according to claim 1, wherein the dielectric coating comprises dielectric particles dispersed therein.

10. The polymer-based material according to claim 9, wherein the dielectric particles are formed of a ceramic material having a higher coefficient of thermal conductivity than the matrix material.

11. The polymer-based material according to claim 1, wherein the polymer-based material is an adhesive that bonds a heat-generating power device to a substrate.

12. The polymer-based material according to claim 1, wherein the polymer-based material encases a heat-generating power device.

13. An adhesive material contacting a heat-generating electronic device, the adhesive material comprising:

about 50 to about 80 weight percent of metal particles having a melting temperature above a maximum operating temperature of the heat-generating electronic device;

a dielectric polymer coating individually encapsulating each of the metal particles so as to electrically insulate the metal particles from each other, the polymer coating having a softening temperature of at least the maximum operating temperature of the heat-generating electronic device but below the melting temperature of the metal particles;

about 0.5 to about 10 weight percent of dielectric particles; and

the balance essentially a polymeric gel in which the metal particles and the dielectric particles are dispersed, the dielectric particles having a higher coefficient of thermal conductivity than the gel.

14. The adhesive material according to claim 13, wherein the dielectric particles are formed of alumina, boron nitride, aluminum nitride, silicon carbide and/or silicon nitride.

15. The adhesive material according to claim 13, wherein the dielectric polymer coating comprises about 50 to about 90 weight percent of second dielectric particles dispersed therein, the second dielectric particles having a higher coefficient of thermal conductivity than the gel.

16. The adhesive material according to claim 15, wherein the second dielectric particles are formed of alumina, boron nitride, aluminum nitride, silicon carbide and/or silicon nitride.

17. The adhesive material according to claim 15, wherein the second dielectric particles are smaller than the dielectric particles dispersed in the gel.

18. The adhesive material according to claim 13, wherein the gel is an epoxy, silicone or polyurethane.

19. The adhesive material according to claim 13, wherein the adhesive material bonds the heat-generating electronic device to a substrate.

20. The adhesive material according to claim 13, wherein the adhesive material encases the heat-generating electronic device.